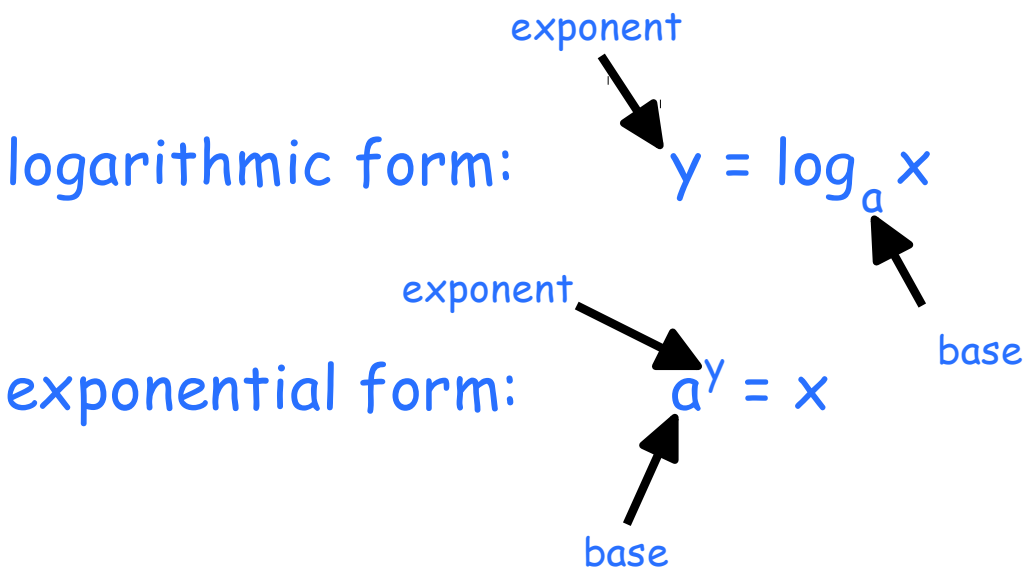
# Unit 16
# Day 3
# The Logarithmic Function
# Section 5.3

## LOGARITHM

For all real numbers $y$ , and all positive numbers $a$ and $x$ , where $a \neq 1$ ;

$$y = \log_a x \quad \text{if and only if} \quad x = a^y$$


exponent
logarithmic form: y = log a x
base
exponent
exponential form: a y = x
base

For each statement, write and equivalent statement in exponential form.

| logarithmic form | | exponential form |
|---|---|---|
| 1) $-2 = \log_{10} .01$ | $\longrightarrow$ | $10^{-2} = .01$ |
| 2) $\log_2 \sqrt{8} = \frac{3}{2}$ | $\longrightarrow$ | $2^{3/2} = \sqrt{8}$ |
| 3) $\log_{4/3} \frac{3}{4} = -1$ | $\longrightarrow$ | $\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$ |

For each statement, write an equivalent statement in logarithmic form.

| exponential form | logarithmic form |
|---|---|
| 4) $2^{10} = 1024$ | $\log_2 1024 = 10$ |
| 5) $\left(\frac{1}{625}\right)^{1/4} = \frac{1}{5}$ | $\log_{\frac{1}{625}} \frac{1}{5} = \frac{1}{4}$ |
| 6) $12^0 = 1$ | $\log_{12} 1 = 0$ |

Find the value of each expression.

7) $\log_{10} .0001$

$10^y = .0001$

$10^y = \frac{1}{10000}$

$10^y = 10^{-4}$

$y = -4$

8) $\log_4 \frac{1}{8}$

$4^y = \frac{1}{8}$

$4^y = 8^{-1}$

$2^{2y} = 2^{-3}$

$2y = -3$

$y = -\frac{3}{2}$

Find the value of each expression.

9) $\log_3 \sqrt{3}$

$3^y = \sqrt{3}$

$3^y = 3^{1/2}$

$y = 1/2$

10) $\log_4 -1$

$4^y = -1$

NR

Solve for x.

11) $\log_x \frac{1}{27} = -3$

$x^{-3} = \frac{1}{27}$

$x^{-3} = 27^{-1}$

$x^{-3} = 3^{-3}$

$x = 3$

12) $\log_5 x = 4$

$5^4 = x$

$x = 625$

# HOMEWORK

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